COUNTRY CASE STUDY: POLAND

Jaroslaw SARUL

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Executive summary

“R&D Intensity case study: Poland” aims to show that Poland, which has been characterised by rather low R&D expenditure over the last few decades, actually has significant innovation potential and ambitious goals in this regard.

Poland's experience in R&D support policy can be valuable for less developed countries who want to develop their innovation.

Introduction

This section will provide an introduction to the case study and the TIP project, and will be pre-filled by the OECD Secretariat. It will present in particular the evolution of key R&D indicators in the country.

1. Setting R&D targets

1) National R&D intensity targets.

The 2030 Responsible Development Strategy adopted in 2017 by the Council of Ministers (Strategia na rzecz Odpowiedzialnego Rozwoju do roku 2020 (z perspektywą do 2030), Warszawa 20171) sets the following R&D-related targets:

- R&D intensity: 1.7% of GDP by 2020 and a target of 2.5% by 2030 (up from 1% in 2015), with an equal share of public and private funding of 60%
- Business enterprise expenditures on R&D (BERD) in relation to GDP: 0.8% of GDP by 2020 and a target of 1.3% of GDP by 2030 (up from 0.47% in 2015)

The target was set in as a consequence of the European Union policy aims.

There are and are being developed also another national programmes and initiatives specifically designed for STI policy. A new strategy of productivity is currently being developed, is intended to replace the existing Strategy for Innovation and Economic Efficiency (Strategia Innowacyjności i Efektywności Gospodarki SIIEG). In the field of higher education and science, the Higher Education and Science Development Programme for

the period 2015 -2030 (Program Rozwoju Szkolnictwa Wyższego i Nauki na lata 2015 – 2030) is in force.

2) **Target changes.**

**Period of the planned economy (1945-1990)**

Poland’s economic policy after the devastation during the World War II underwent radical changes, shifting away from the planned economy (1945-1990), with a major state intervention in the financing of R&D activities and characterized by a small share in the world trade and economy, towards market liberalism, leading to profound structural changes and a decrease in state funding for R&D. In Poland's post-war history, the policy on supporting research and development was characterised by great instability.

Indeed, during the period of the planned economy (1945-1990), targets related to the development of scientific and research, were set in socio-economic plans. During the communist period, a total of seven socio-economic plans were implemented in Poland, mostly five-year periods. Since the ideological basis of the state was the so-called "scientific socialism", scientific studies were treated as an important factor in the growth. The aim of the research was to strengthen the potential of the economy, in particular the defence sector and economic and technological independence from Western countries. The best period of the Polish People's Republic is considered the decade of 1970-1980, when attempts were made to modernize and open up the Polish economy. At that time, attempts were made to meet the social needs of a impoverished society. Mistakes in economic and social policy led in the late 1970s. to the economic crisis. After 1980, it was necessary to reduce employment by 25% of academics. This hit the scientific community heavily involved in the "Solidarity" movement, which was established in 1980. This process forced the economic crisis, and R&D spending decreased from almost 1.5% to less than 1% of gross domestic product.

The last communist-led the National Socio-Economic Plan for 1986-1990, predicted a dynamic increase in R&D spending, identified the following areas of concentration of science and technology tasks: digitisation, automation and robotics, development of energy and nuclear technology, new materials and technologies, biotechnology, new technologies for the acquisition and processing of raw materials, the development of modern means and transport systems, the modernisation of the food economy, health protection, working conditions and the environment, normalisation and metrological work. The share of research and development expenditure in the national income divided was expected to increase from 1.7% in 1985 to at least 3% in 1990.

R&D expenditure in 1991 amounted to 1.16% of GDP, of which 0.76% of GDP was spent by the state budget. In 1999, R&D expenditures stood at just 0.72% of GDP, with 0.46% of GDP from the state budget.

**The Strategy “Poland 2025” (2000) set a R&D target4.**

In 2000, Poland set a national R&D target in the Strategy “Poland 2025 – Long-term strategy for sustainable development”, adopted by the Council of Ministers in July 2000 in order to

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2 In addition, there was a rigorous prescriptive and distribution system, annual plans covering all forms of social and economic life, businesses and even individual farms.

3 According “Poland 2025 – Long-term strategy for sustainable development” Warszawa 2000 p. 54

close the wealth gap with the EU. The strategy planned to increase the budget expenditure on science faster than the rate of GDP Growth, to increase the share of economic entities in the financing of R&D activities to around 70% (until 2025), and to implement institutional reforms of the science system. This strategy is currently not in force.

The Strategy “Poland 2030” (2013) set a R&D intensity target, of 1.7% of GDP by 2020 and a target of 3.0 % by 2030⁵.

Following the EU membership in 2004, Poland adopted the Lisbon Agenda, to implement indicators and policies conducive to the increase of innovation and competitiveness at the national and EU levels.

In 2013, the Council of Ministers adopted the Strategy “Poland 2030. The third wave of modernity. Long-term National Development Strategy” (Długookresowa Strategia Rozwoju Kraju. Polska 2030. Trzecia Fala Nowoczesności). A list of indicators contained more than 20 items concerning competitiveness and innovation. Among them, a few indicators concerning R&D intensity (see Annex I), including: the GERD target of 1.7% of GDP by 2020, and 3% by 2030.⁶ The target related to “High technology” participation rate in exports by 2020 is 15% (from 3.1% in 2009). This strategy is currently not in force, the 2017 Strategy has been replaced.

3) Subnational targets.

In 2019, the Government adopted National Strategy for Regional Development 2030 (NSRD) (Krajowa Strategia Rozwoju Regionalnego 2030⁷). It is a fundamental strategic document of the State's regional policy, considering the provisions of the Strategy for Responsible Development. The document identifies the objectives of regional policy, actions and tasks to be achieved, by the Government, regional and local authorities and other actors involved in the implementation of this policy.

In addition, the administrative 16 regions (Voivodship) of Poland (NUTS-2) has its own development strategy⁸, adopted by regional authorities, which also takes into account R&D objectives.

Regional strategies are developed by the Provincial Board, adopted and monitored by self-government bodies. Regions finance their strategies using their own resources, central resources (through government-region contracts), EU regional operational programmes and EU national operational programmes.

Other regional instruments are Regional Research Agendas, Regional Smart Specialisations (RIS), Regional Innovation Centres.

The Polish regions strategies have been approved at the beginning of the decade, and the duration of which ends around 2020 or new strategies with validity until 2030.

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⁶ The 2013 government strategy adopted more ambitious submissions on R&D expenditure (3% of GDP in 2030) than the later (applicable) 2017 Strategy (2.5% of GDP in 2030).
⁸ As of January 1, 2018, the NUTS 2 division covers 17 regions and is no longer consistent with the number of provinces in Poland due to the division of the Mazovian Voivodeship into two regions: Warsaw Capital and Mazowiecki Regional.
The eleven of these strategies have planned specific aims for research and development and innovation. The main indicator for this objective is “expenditure on R&D in relation to regional GDP, per capita or as an amount”. The highest average expenditure on R&D activities is recorded for the Masovian province (in this Warsaw capital region – in 2017 it was PLN 2,520.7 per capita, whenever a national average of PLN 535.6). In regions with the lowest R&D inputs in eastern Poland, the expenditure is growing fastest, resulting in a closer this regions to the national average.

<table>
<thead>
<tr>
<th>Voivodship</th>
<th>Indicator name</th>
<th>Initial value</th>
<th>Expected value 2020</th>
<th>Expected value 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dolnośląskie</td>
<td>R&amp;D expenditure in relation to the GDP of the province</td>
<td>2015: 0,85%</td>
<td>1,1%</td>
<td>2,0%</td>
</tr>
<tr>
<td>Śląskie</td>
<td>Same as previous</td>
<td>2010: 0,46%</td>
<td>1,7%</td>
<td></td>
</tr>
<tr>
<td>Pomorskie</td>
<td>Same as previous</td>
<td>2009: 0,52%</td>
<td>Achieving the national average</td>
<td></td>
</tr>
<tr>
<td>Zachodniopomorskie</td>
<td>Same as previous</td>
<td>2017: 0,45%</td>
<td>0,6% - 0,7%</td>
<td>1,1% - 1,3%</td>
</tr>
<tr>
<td>Lubuskie</td>
<td>Same as previous</td>
<td>2010: 0,14%</td>
<td>0,5%</td>
<td></td>
</tr>
<tr>
<td>Łódzkie</td>
<td>Same as previous</td>
<td>2010: 0,63%</td>
<td>1,0%</td>
<td></td>
</tr>
<tr>
<td>Warmińsko- Mazurskie</td>
<td>Same as previous</td>
<td>2010: 0,44%</td>
<td>1,443%</td>
<td>2025 – 2,144%</td>
</tr>
<tr>
<td>Lubelskie</td>
<td>Same as previous</td>
<td>2010: 0,64%</td>
<td>0,84%</td>
<td></td>
</tr>
<tr>
<td>Wielkopolskie</td>
<td>R&amp;D per capita outlays [PLN]</td>
<td>2017: 357,0 PLN</td>
<td>Increase</td>
<td></td>
</tr>
<tr>
<td>Podkarpackie</td>
<td>Same as previous</td>
<td>2011: 254,8 PLN</td>
<td>350 PLN</td>
<td></td>
</tr>
<tr>
<td>Mazowieckie</td>
<td>Expenditure on the innovation activities of industrial enterprises and the services sector in Masovian Province (absolute value)</td>
<td>2011: 12,5 billion PLN</td>
<td>19,0 billion PLN</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Share of the Mazovian Province in the expenditure on the innovation activities of industrial enterprises and the services sector of the country</td>
<td>39,4%</td>
<td>42,0%</td>
<td></td>
</tr>
</tbody>
</table>

Not all regions have specific R&D objectives. The regions have limited resources mainly from the Regional Operational Programmes. However, they attach great importance to the development of local innovation ecosystems.

4) **Target criteria.**

The target was based on scenarios developed taking into account past R&D performance.

The latest GERD forecast for Poland in 2020 was developed by the Ministry of Science and Higher Education in response to the publication by the European Commission of the EU 2020 strategy document, indicating as one of the objectives to achieve 3% of total investment in activities GDP (GERD) in the EU by 2020.

In drawing up the forecasts, the following assumptions were made:
• Average real GDP growth for 2010-2020 of 3% and an average annual inflation rate of 1.5% was adopted.

• Amounts from the State Budget, structural and other expenditures have been adopted as the basis of public expenditure.

• An increase in nominal budget expenditure from Part 28 Science in 2011-2020 was adopted at an average of 14% per year.

• Three options for the allocation of structural funds for the period 2013-2020 for R&D activities were considered.

• Two scenarios for private participation in general R&D expenditure were considered: 30% and 50% (increase in private expenditure resulting from the achievement of an appropriate state of development of enterprises and government innovation policy).

Taking these baselines into account and implementing all possible scenarios has shown that it is possible to achieve total R&D expenditure between 1.08% and 1.96% of GDP. Rejecting the extreme options, it was proposed to adopt the GERD value in GDP at 1.7%, with an equal share public and private sector of 50%.

5) **The indicator.**

Somewhat agree.

The R&D intensity indicator can be considered as a good (however not sufficient, as explained in the section below) indicator of country innovation. The indicator at the country level allows for measuring the involvement of residents in the creation of new knowledge (basic and applied scientific research) and experimental development. High intensity of R&D inputs can contribute to the development of innovation, i.e. new or improved products or processes. The R&D intensity indicator is one of the main indicators related to R&D activities and is the most widely used indicator in international analyses.

R&D does not sufficiently capture broader innovation activities such as the costs of commercialising solutions and scaling up production that are important in the country.

In my opinion, consideration should be given to presenting R&D intensity data not only on GDP volumes, but also in relation to investment in the economy, which will better show the intensity of expenditure and modernisation of the economy, in particular in countries where low-cost development factors and imitation innovations dominate. It has been 30 years since Poland has started its socio-economic transformation, with an uninterrupted pace of high growth averaging 4.2% per annum in the period 1992-2019.

6) **Indicator challenges.**

Research and development are concentrated in a small number of foreign and larger companies and a relatively small start-up group. Another cause of relatively low levels of R&D intensity, one of which is the sectoral structure of the economy with a huge number of small conservative family small businesses and large share of resources industries and services.

Another challenge is that we do not collect information in R&D activity studies on whether the internal expenditure incurred by the unit for R&D activities was used for works that have been successful, have been discontinued, concerned research primary knowledge progress and will not be used economically, they were sold to other entities, were implemented in their activities in Poland or, have been transferred to other entities foreign (transfer of innovation).
In general, we believe that GERD and others R&D expenditure intensity indicators for the GDP, are no longer a sufficient set of indicators are use. In many cases, data collected on this way do not allow for inferring on R&D input productivity, which is now becoming the most important challenge:

- In cases of high impact of public institutions on the economy, the level of R&D expenditure does not reflect real market demand, for such expenditure, but shows level of financing political priorities (centrally planned economy, structural funds schemes);
- During periods of expansive economic policy, where economic growth is stimulated by the “cheap factors’ of production, increasing expenditure on R&D are not visible, against the growing economy statistics data;
- Polish companies during the last thirty years of intensive development and restructuring, relied mainly on technologies and investment goods imported from abroad, in a small extent creating demand for domestic research. The follow-up innovation processes are not reflected in R&D statistics, as well as innovations not related to research.
- Companies often fail to report (unless they have an interest in this) investments in R&D as investments in intangible assets. It is only the introduction of new instruments, e.g. tax advantages, encourages stimulates economic operators to demonstrate R&D investments;
- In the age of globalisation, the R&D expenditure in individual countries, can translate into economic benefits in other countries. The essence of the current phase of the globalisation of innovation is the spatial separation of the places, where innovation are invented, where are undertaken theirs development, and the localizations, where they are offered on global markets, generating profits and benefits.

There is certainly a need to consider new indicators complementary to existing one, in order to reflect the phenomena mentioned above.

1. Consideration should be given to presenting data on R&D intensity not only on GDP volumes, but also for investments in the economy that better show the intensity of expenditure and the modernisation of the economy not only related to research. In less developed countries, imitation innovation is the dominant.

2. It is also important to look at the world economy from the point of view of the flow of benefits related to the financing, creation, development and commercialisation of innovation. The indicator should take into account imports and exports: "High technology" and "intangible values" participation rate in exports.

7) Other targets

The documents produced at the government level are based essentially on the small number of indicators previously given and on data collected by the CSO.

As part of the European Union, Poland participates in collecting a set of innovation indicators data, at national and regional level, known as the European Innovation Scoreboard (EIS) and Regional Innovation Scoreboard (RIS)⁹.

⁹ https://ec.europa.eu/docsroom/documents/38781
According to the study: Innovation active industrial enterprises by voivodships, the following data set is collected in the region in the region layout (voivodships)\(^{10}\)

- Innovation active service enterprises;
- Revenues of industrial enterprises from sales of new or improved products as the share of total revenues from sales;
- Revenues of service enterprises from sales of new or improved products as the share of total revenues from sales;
- Expenditures on innovation activities in industrial enterprises;
- Expenditures on innovation activities in service enterprises;
- Enterprises which incurred expenditures on innovation activities;
- Industrial enterprises which received public support financial for innovation activities in the years as the share of innovation active enterprises;
- Service enterprises which received public financial support for innovation activities in the as the share of innovation active enterprises;
- Industrial enterprises which participated in innovation activities co-operation as the share of innovation active enterprises;
- Service enterprises which participated in innovation activities co-operation as the share of innovation active enterprises;
- Industrial enterprises which participated in cluster co-operation;
- Service enterprises which participated in cluster co-operation.

Provincial strategies set GERD objectives. In addition, these strategies will use dozens of different innovation indicators.

2. Implementing R&D targets and policies

8) **Policy initiatives in place**

**The 2030 Responsible Development Strategy – 2017**

The strategy is funded by State funds, EU funds and private funds. For information on this document, see: 1. Setting R&D targets 1).

The Council of Ministers is in charge of the implementation and monitoring of the initiative.

**The 2030 National Strategy for Regional Development – 2019**

The strategy is funded by State funds, EU funds and private funds.

The Ministry of Funds and Regional policy is in charge of the implementation and monitoring of the initiative. 1. Setting R&D targets 3).

**Operational Programme Smart Growth – 2014 2020**

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SG OP is a national operational programme financed by the European Regional Development Fund (ERDF). The allocation of ERDF funds for SG OP amounts to EUR 8,613,929,014. The minimum involvement of national funds is EUR 1,575,940 at the time of programming. The Ministry of Funds and Regional policy is in charge of the implementation and monitoring of the initiative.

**Operational Programme Digital Poland – 2014-2020**

The aim of the programme is to strengthen digital foundations for the national development. The Ministry of Funds and Regional policy is in charge of the implementation and monitoring of the initiative.

**Operational Programme Knowledge Education Development – 2014-2020**

The OP KED is a response to challenges and at the same time an instrument for implementing the Europe 2020 strategy.

The Ministry of Funds and Regional policy is in charge of the implementation and monitoring of the initiative.

9) **Successful policies**

The most successful actions to improve innovation, competitiveness and productivity, the science and research sector in Poland, are innovation laws.

In this regard, four new laws, resulting from the White Paper on innovation of the Ministry of Science, and Higher Education (MSHE), promoting innovation and science-industry knowledge transfer have recently entered into force:

**The First Innovation Act (2017)**, introduced the following important regulations, taking effect from 1 January 2017:

- The abolition of income tax on intellectual and industrial property;
- Extending to 6 years the deductibility of costs for R&D activities;
- A cash return for emerging companies in the absence of a tax credit;
- Stabilising funding for activities related to the commercialisation of research and development results;
- Simplification of the procedure for the acquisition by researchers of property rights to research results;
- To make the rules of public legal persons in possession of the research infrastructure more flexible;
- To enable the financing of projects related to the implementation and functioning of the Environmental Technology Verification System (ETV).

**The Second Innovation Act**, which amended the first Innovation Act, with the following further tax changes:

- Increased the amount of tax credit per activity (R&D to 100% and CBR research and development centres up to 150%).
- The catalogue of eligible costs for the R&D reduction has been clarified and extended and the use of the R&D reduction has been facilitated by a broader group of economic operators.
Introduces pro-innovative changes in the field of science and higher education, enabling greater scope for the work of special-purpose companies created by universities, research institutes and scientific institutes of the Polish Academy of Sciences (PAS) on economic activity.

Measures were taken to strengthen the entire institutional and social sphere of innovation, i.e. the Liberalising the self-government of patent attorneys.

The first effects of the tax changes for fiscal year 2018 are an increase of the consideration of R&D expenditures by R&D companies, and a significant increase of the private R&D expenditures.

According to the CSO data, intramural R&D expenditure increased by almost 25% in 2018. In 2018, gross domestic expenditure on R&D (GERD) amounted to PLN 25.6 billion and increased by 24.6% compared to the previous year. R&D activity in GDP was 1.21% (in 2017 – 1.03%). The average value of intramural expenditure on R&D per capita was PLN 668 and increased year-on-year by 24.7%. The largest intramural expenditure on R&D activities in 2018 was allocated by the business enterprise sector (BERD) – PLN 17 billion (an increase of 27.7% compared to 2017). This was 66.1% of gross domestic expenditure on R&D. The next sector was higher education (HERD) – it was 31.7% of GERD, followed by government sector (GOVERD) - 1.9% and private non-profit sector (PNPERD) – 0.3%.

Among the implementing sectors, the highest intramural expenditure on R&D was characterised by the business enterprise sector, which allocated PLN 17.0 billion for research and development (an increase of 27.7% compared to 2017). This represented 66.1% of gross domestic expenditure on R&D in 2018 compared to 64.5% in 2017. Higher education expenditures on R&D (HERD) as a share of GERD was 31.7%, GOVERD 1.9% and PNPERD 0.3%, compared to 32.9%, 2.3% and 0.3% respectively in 2017. As in previous years, the main sectors financing R&D activities in 2018 were the business enterprise sector and the government sector, with 53.3% and 35.4% (compared to 52.4% and 38.3% respectively in 2017) of all expenditure incurred in conducting research and development. Attention is drawn to the dynamic growth of BERD.

At present, I cannot estimate to what extent tax changes alone have led to rapidly increasing R&D spending in the business sector? I think this has been due to the interoperability of many positive economic and political signals, including tax incentives, the launch of support programmes under national and EU measures.


The Łukasiewicz research network, has the task of research critical to the country policy and the commercialization of research. It is a great national scientific network of the scientific research which consists on 37 research institutes, which employed is ok. 8 thousand employees. The Łukasiewicz research network, will be the third largest this kind of conglomeration in Europe after, German Die Fraunhofer-Gesellschaft and the French network of Carnot.

The vocation of the Network a positive impact on the conditions of operation of companies in Poland, who it will benefit from easier access to the results of research and development. It will also partner for large foreign entities who wish to cooperate with Polish R&D sector.
The law on supporting the scientific activities of the Polish Science Fund (ustawa z dnia 4 kwietnia 2019 r. o wspieraniu działalności naukowej z Funduszu Polskiej Nauki Dz.U. z 2019 poz. 823).

Another instrument is the Act of supporting scientific activities of the Polish Science Fund, which creates a new mechanism for the financing of research and development and commercialization—the Fund Polish Science. The Act creates a mechanism for financing research activities in innovative formula is a virtual research institutes (WIB). WIB is the form of labour organization selected, competitive at the international level research teams engaged in research activities with high potential socio-economic applications.

10) Unsuccessful policies

The instruments for financing research and development of the European Union are regarded in Poland as an important component of the system of R&D and the factor for its internationalisation. Since Poland's accession to the EU, there have been high expectations of access to EU funds and programmes. Not all expectations in this area have been achieved and the level of Polish participation in EU programmes has become a political problem.

So far, the amount of funds raised by the Polish entities have not balanced Poland's financial contribution to the implementation of EU scientific policy (EU Framework Programmes. Poland is therefore, contrary to its intentions, a net contributor to the European Union's research and development policy. The Horizon 2020 budget is close to EUR 80 billion. Poland's contribution to the budget "H2020" is around 3% and payments to Polish entities are much less.

This situation has various negative consequences. Although Polish companies and universities have access to other EU funds (e.g. cohesion policy grants), their insufficient participation in the Framework Programmes contributes to insufficient internationalisation of research in Poland. In order to improve the situation, the system supporting implementation has been strengthened organisationally. It plans to expand the scope of training for beneficiaries, improve information policy and strengthen negotiating potential. The Ministry of Funds and Regional Policy has taken over the coordination of all activities related to programmes managed by the EC. In order to prepare projects for Horizons, Europe will be able to use EU Structural Funds and national sources.

"Horizon 2020" is the prototype of the new "Horizon Europe" programme for the period 2021-2027, with an even larger budget of EUR 100 billion. The Strategy of the Polish Government assumes that Poland's contribution to the budget of the framework programmes and the amount of resources from these programmes will be balanced.

Another challenge for the EU is that in the projects and programmes now implemented, there is often no close distinction between scientific and innovative projects. In the first years of EEC's existence, the principles of research and development policy were formulated by the Commissioner of the European Commission, called the Riesenhuber Criteria. They involved a few unfortunately forgotten rules, e.g. separating scientific and innovative projects. The application of these legitimate principles should be restored.

11) Implementation challenges

The challenging characteristics of the Polish Innovation system
Innovation policy in Poland has many dynamic changes over recent years, but progress on the results of innovation support policy are insufficient. There is a risk for Poland falling into the “trap of medium-sized incomes”.

The gaps of the existing characteristics of the Polish innovation system include:

- Imitating as a source of the majority adopted innovations.
- Poor cooperation between business and innovators: the challenge of changing the model of innovation into a more creative innovation model is debated.
- Barriers to the development of innovation of Polish companies are risk-taking concern, and low management motivation to invest in innovation and training of highly skilled staff.
- Inventions arising at universities and research institutes are rarely commercialized.

**The object of investment – the difficulty to fund small companies**

The Polish small companies, which dominate the Polish economy, are characterised by low productivity level and low propensity to implement innovations.

In this regard, the public debate on support for innovative companies or research teams, currently focuses on the following topics:

- Increasing the number of enterprises introducing innovations;
- Encouraging enterprises to increase their use of the public research system and Strengthening cooperation between the science and industry;
- Simplifying existing support instruments to make them more attractive to companies;
- Determining the level (national or regional) whereby support for innovative companies is more effective;
- Determining the type of support for enterprises that is more effective (e.g. horizontal tax reliefs, grants or support through investment funds);
- Preparing enterprises for the challenges related to the digital revolution and climate change;
- Having the state or public bodies address emerging social challenges through the coordination and implementation of innovative solutions.

**The reliance of Polish innovation system on the innovation priorities proposed by the European Commission.**

The existing Polish innovation system is largely based on EU funding, and this results in reliance on the priorities proposed by the European Commission. Thus, a particularly topical challenge is to consider instruments and solutions to address the weaknesses in the innovation support system, coming from sources the EU and domestic such as:

- The mismatch between the types of instruments to the real needs of social and economy
- The excessive share of non-refundable assistance
- The mismatch between the pro-innovation expenditure structure to the needs of companies.
On average, foreign funds account for around 8 years of the 10.5% R&D expenditure. It should be assumed that the financing of the EU projects requires comparable amounts of national funding and, later, expenditure in the operational period of the projects.

Discussions on the causes of such situation and the effectiveness of the system of creation and promotion of innovation, through the Polish and European innovation policy, were ongoing, when the programming period for EU funds ended in the 2007-2013 programming period when was prepared for the 2014-2020 period.

**Cooperation between businesses and academia**

Insufficient demand for research from companies had an objective reason for the so far based imitation innovations of economic development. At the moment, however, the situation is changing. Many programmes serve the activation of cooperation between scientific communities and enterprises. However, scientific institutions have significant and un fully exploited potential in many areas.

12) **The role of policy and other factors**

In 2016, the Council of Innovation (Rada ds. Innowacyjności) was set up. Innovation, which is the most important inter-ministerial coordinator of the government's innovation policy, included in the public administration system. The President of Poland has a Council for Development, bringing together the leading partners of different scientific and social business backgrounds.

In recent years, innovation policy in Poland has been undergoing many changes. The general finding is an insufficient progress in terms of performance of the innovation system and of the economy as a whole.

Different actions are undertaken to tackle this situation:

- An ongoing comprehensive legislative reform programme.
- The ongoing modifications of the innovation support system in the new financial perspectives of the European Union.
- Changes, in the future programming period of the European Union, of the research funding system to foster the economy and commercialisation of research.
- The Strategy for Responsible Development points out the challenge to increase the share of the high-technology sector in the economy, and in particular, the adaptation of innovative solution to the country’s exported products and services that are sought in world markets. The document highlights a dozen industries worth developing, including biotechnology, communication technologies, and robotics.
- An underway Polish work on productivity strategy, which affirms a strong link between innovation and productivity, will be accepted within several months. Indeed, the Polish Economy is less productive comparing to the western European countries, but it has huge reserves in terms of many factors affecting productivity: the depletion of “low-cost factors” of production, such as human resources, cheap raw materials and fuels, will foster productivity growth.

13) **Policy lessons**
As mentioned earlier, the intensive process of modernization of the country in the last 30 years was mainly based on the import of modern technologies and the innovation of the imitation type. The efforts made after Poland's accession to the EU in 2004 to support innovation and the R&D sector initially had limited effectiveness. Currently, however, Poland has a very extensive complex in dozens of institutions at national and regional level co-creating a system of support for research and development, funded by national and EU funds.

The Polish approach to innovation policy is mainly based on following the model of western European countries, which involves spending large resources on research and development activities, modern technologies. However, developing countries do not have to follow this difficult path. This policy aims to further increase R&D spending and to follow the path of smart specialisations – developing innovations, which a country believes it gives a comparative advantage over others. However, the approach of innovation in developed countries is too standardised and rigid, preventing practically spontaneous, unconventional activities – intuitively associated with innovation, which can be an asset for developing countries, instead of some inefficient bureaucratic institutions of developed countries.

It is important to analyse and to take advantage of endogenous potentials. The pillars of European exports are not only relying on big companies, but also on global small and medium-sized businesses, called “hidden champions”. They occur in more mainly Germany, Italy, Austria, Denmark, etc.). These businesses have a positive impact on improving the trade balance of these European Union countries. In the processes of globalisation and privatisation of developing countries' economies, such companies can be destroyed, as has been largely the case in central and eastern European countries.

Innovation policies of developing countries should rather be oriented to address the link between innovation support policies and addressing internal development, market and social needs (healthcare, environmental protection, climate change mitigation). Innovation policy should help to solve real problems in the economy or society, rather than developing technologies in itself. For instance, the concept of “frugal innovation” is to create massively useful and affordable solutions to improve the quality of life of societies, in a context of limited resources.

The prevention of brain and innovation drain is also a significant issue. In this regard, on September 29, 2019, The Polish Prime Minister said: “over 20,000 doctors have left Poland in Twenty years” “the education of one doctors costs about 1 million zlotys”, which – after conversion – gives about 25 billion zlotys. “What does it mean? That relatively poor Poland, (…) paid for the education of doctors for rich countries”.

3. R&D targets and innovation disparities

14) Innovation disparities

The innovation disparities within Poland are very significant.

There are also large sectoral disparities, resulting from the failure to adapt the structure of research capacity to the requirements of the modern economy. In the economy, sectors linked to foreign capital represents a higher level of innovation. The innovation of small and medium-sized enterprises is relatively low.

15) Territorial disparities

The most important disparities is undoubtedly spatial diversity. About 35-40% of the research potential is located in Warsaw (the capital of the country). In addition, there are several fairly
and traditional strong academic centres, such as: Silesia, Kraków Gdańsk, Poznań, Wrocław. The eastern part of Poland is much less innovative.

**The National Regional Development Strategy (NSRD)**

The overarching document integrating the various aspects of territorially sustainable development is The National Regional Development Strategy (NSRD) mentioned before. It covers both the instruments and structural policies of the European Union, the national instruments of tax, economic and scientific policy.

- The NSRD 2030 aims to develop the competences necessary for effective development policy, particularly in areas with low developmental potential. Regional policy of the State support and develop interactions and links between local and regional public institutions and the world of business and science.
- The strategy proposes new solutions such as an innovative territorial partnerships, a system of coordination of national Smart specialisation and regional smart specialisation, an integrated innovation support system.

**Innovative territorial partnerships**

The programme aims to seek innovative solutions in the implementation of public tasks, in cooperation between different types of partnerships: public, private and social partners, as well as territorial partnerships: urban-rural and rural-countryside. The aim of the project is to identify factors that slow down development processes and to develop and implement new, innovative solutions contributing to the effectiveness of cohesion policy instruments in achieving the objectives pursued.

It concerns both financial and non-financial solutions, contributing to minimising or reducing the development barriers and to strengthening economic activity in the identified development potential in a selected area (a medium-sized city with Functional area or a group of rural municipalities and small marginalised towns).

The project will be implemented using a participatory model aimed at animating the partnership participants and other stakeholders involved in the process, thereby contributing to the creation of a supportive Collaborative environment. Potential areas of collaborative partnerships, for example: public services tailored to the needs of the population, including the ageing population (e.g. integrated social and health care), transport services, business development and renewal initiatives Spatial planning in the functional area.

**System of coordination of National Smart Specialisation NSS and Regional Smart Specialisation**

Establish a NSS and RSS coordination model to synchronising support and ensuring complementarily and synergies between e.g. animation of joint projects related to NSS and RSS, analysis of legislative, organisational, institutional, financial, etc., the development of innovation maps indicating the activity of enterprises in applying for public funds, and Identification of sectors where traders do not apply for public support and are characterised by high development potential and high private expenditure on R&D activities; Develop joint action plans.

**Integrated Innovation Support System**

Developing with regions, entrepreneurs and the scientific community and other partners with common objectives of innovation policy, orientations, including instruments to support
desirable products and processes, together with a definition of their level of implementation in Country-Region layout.

16) Sectoral disparities

According to a new study by CSO "Innovative activity of enterprises in the years 2016-2018"11
"In the years 2016–2018 innovation active industrial and service enterprises constituted 26.1% and 21.0%, respectively, of the total number of such kind of entities. The highest percentage of the innovation active enterprises was again found among the largest entities. In the years 2016–2018 a share of innovative industrial and service enterprises amounted to 24.0% and 19.6%, respectively. Product or business process innovations were most frequently introduced by entities hiring 250 or more persons (62.3% of industrial enterprises and 46.6% of service enterprises). In industry, during the analysed period, relatively the largest number of innovative enterprises was in the section Manufacture of pharmaceutical products – 52.0% and Manufacture of computer, electronic and optical products – 51.6%, while the least - in the Remediation activities – 7.4%. Among service enterprises, the highest share of innovative enterprises was in the Insurance, reinsurance and pension funding." ... "The results of an innovation survey show that among industrial and service enterprises prevailed the ones which introduced business process innovations (new or improved business processes) in the period 2016- 2018, as in the previous years, rather than product innovations (new or improved products)"

The answer to the aforementioned weaknesses is the Responsible Development Strategy. Five strategy papers are currently being worked on to implement the objectives of the Strategy. The selective nature of the approach is of a key importance for the Strategy, meaning to only focus on those products, technologies, industries or sectors which are essential for tangible impact on an increase in both productivity and wages of the citizens. In addition, it is also important for more effective utilization of the potential of the economy.

Essential for the determination of RDS objectives and implementation are:

(1) Selectivity of approach - concentration, finding a niche, industries/sectors.
(2) Integrated approach - management organised around strategic objectives, coordination of sectors and territorial differentiation.
(3) Cooperation, partnership and shared responsibility of public entities, business and citizens in the implementation of public policies.
(4) Increasing Poland’s activity on the EU forum and in the country’s neighbourhood.
(5) Mobilisation of domestic capital.

17) Other country characteristics

A characteristic feature of Poland is its reliance on European policies in the field of policy innovation. A large part of the funding of the R&D sphere in Poland comes from external resources.

11 Ibidem p.22
4. R&D targets in the digital age

18) **Policy strategies**

There are many paths to discussions on innovative policy strategies involving scientific circles and entrepreneurs.

Public debate and various social and local government bodies play an increasingly important role in shaping research and development policy.

In recent years, there has been a public debate in the country on research and development policy. A positive example in this regard is *The White paper Innovation* a collection of more than 340 requests and proposals developed in the process of public consultation between representatives of the Government, science and the economy. This was the basis for the work on the new Law on Higher Education and Science and the new laws on innovation.

19) **Policy initiatives.**

The new regulations developed by the MISHE contribute to the foundation for the development in Poland of an innovative knowledge-based economy, providing a greater supply of knowledge, educated labour and scientific discoveries for innovation in the future.

The new regulations developed by the MSHE aims to make Polish scientific bodies efficient and to build strong partners for economic operators. We expect that the new regulations will result in the coming years, with the improvement of managerial skills for entrepreneurs.

The most important actions to improve innovation, competitiveness and productivity, the science and research sector in Poland are:

*The adoption new laws on higher education and science, innovation*

The adoption new laws on higher education and science, innovation creating new tax measures and incentives for innovative activities. In this regard, the most important a policy initiative was the reform of science and higher education in Poland ("The Constitution for Science", also known as the “Law 2.0”). The act of the implementation (The Act of 20 July 2018 Law on Science and Higher Education and the Act of 3 July 2018 on the Implementation of the Law on Higher Education and Science) were adopted in July 2018, and entered into force on 1 October 2018. The reform aims to (i) give higher education institutes (HEIs) more autonomy; (ii) increase the impact of research performed in Polish institutions on world science; and, (iii) improve the quality of education, including doctoral training.

*Industrial doctorates*

The programme of industrial PhD trainings gives entrepreneurs an opportunity to hire a talented early-career researchers who can solve technological problems their companies are struggling with. Under the programme, a PhD student works in two places - in a company and research unit. The Industrial doctorate programme, involving over 1000 doctoral students and 600 enterprises. In 2019 an additional module entitled ‘Industrial Doctorate II – Artificial Intelligence’ was introduced, under which a financial support is provided for the preparation of doctoral dissertations by doctoral students who conduct research on the use of artificial intelligence in technological or social processes, including cybersecurity, and the findings of such research may be applicable to the activity of entities employing doctoral students.

*Start in Poland Programme*
The implementation of the Start Programme was initiated in Poland in order to create favourable conditions for the activity of start-ups at each stage of their development, starting from the stage of incubation and acceleration, through the stage of development and international expansion, to the incentives for foreign entrepreneurs to set up start-ups and develop their activity in Poland.

**Research network Łukasiewicz**

The Research network Łukasiewicz is a great national scientific network of the scientific research, which has the task of research critical to the country policy and the commercialization of research (https://lukasiewicz.gov.pl/en/). With 8,000 staff and 38 research institutes located in 11 cities across Poland, it is the third largest research network in Europe. The basic task of the network is to conduct application research and development works, which are particularly important for the country’s innovation policy as well as provide the transfer of knowledge to the economy.

**The law on the promotion of scientific activities**

The law on the promotion of scientific activities from the Polish science-introduction of modern financial instruments and the development of strategic directions for the advancement of science.

**Virtual Research Institute**

Creating new medicine is a risky and time-consuming process. The development of innovative molecules is often over a decade, their costs are very high, and the probability of success is small. To support research in applied science, the Government has created a dedicated financing instrument – Virtual Research Institute. The Act of supporting scientific activities of the Polish Science Fund, which creates a new mechanism for the financing of research and development and commercialization-the Fund Polish Science. The Act creates a mechanism for financing research activities in innovative formula is a virtual research institutes (WIB).

**20) New targets**

The 2030 Strategy for Responsible Development (SRD) sets out “new targets”, by setting out over 700 actions to increase the income of Polish citizens and strengthen social, economic, environmental and territorial cohesion, within the country.

**The Package for Clean Transport**

It includes such documents as the Plan for the Development of Electromobility, the National Framework for the Development Policy of Alternative Fuels Infrastructure and the Act on Electromobility and Alternative Fuels. Due to a number of different initiatives, it was also decided to prepare a financial instrument that would support the implementation of the measures provided for in these documents: the Low-Carbon Transport Fund, which by 2027 will manage PLN 6.7 billion (EUR 1.6 billion).

**“Clean Air” Program**

In 2018 the Polish government launched "Clean Air" program. The main goal of the program is to improve the energy efficiency of existing buildings and to significantly reduce the emissions of atmospheric pollutants. The Polish government is trying to create favourable conditions for the construction of a profitable, effective and modern hard coal mining sector, based on cooperation, knowledge and innovation. Pure, innovative coal technologies such as coal gasification are being tested in Silesia. The implementation will take ten years and its total budget will be PLN 103 billion (EUR 24 billion).
ANNEX

Table 1. The goals to be achieved in the perspective by 2020 and 2030 set in The Responsible Development Strategy

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Unit of measurement</th>
<th>Base value (base year)</th>
<th>Mid-term value 2020</th>
<th>Target value (2030)</th>
<th>Sources of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenditures on R&amp;D in relation to GDP</td>
<td>%</td>
<td>1.0 (2015)</td>
<td>1.7</td>
<td>2.5</td>
<td>CSO(^{12})</td>
</tr>
<tr>
<td>Business enterprise sector expenditures on R&amp;D in relation to GDP (BERD)</td>
<td>%</td>
<td>0.47 (2015)</td>
<td>0.8</td>
<td>1.3</td>
<td>CSO</td>
</tr>
<tr>
<td>Share of Polish undertakings/project in the value of programmes managed by</td>
<td>%</td>
<td>1 (2014)</td>
<td>2.5</td>
<td>5.0</td>
<td>Ministry of Finance</td>
</tr>
<tr>
<td>the European Commission(^{13})</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Table 2. Two examples of R&D intensity target included in the Strategy “Poland 2030. The third wave of modernity. Long-term National Development Strategy”\(^{14}\).

<table>
<thead>
<tr>
<th>Indicator</th>
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<th>Mid-term value 2020</th>
<th>Target value (2030)</th>
<th>Sources of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenditures on R&amp;D in relation to GDP (GERD)</td>
<td>%</td>
<td>0.75 (2010)</td>
<td>1.7</td>
<td>3.0</td>
<td>CSO</td>
</tr>
<tr>
<td>‘High technology’ participation rate in exports</td>
<td>%</td>
<td>3.1 (2009)</td>
<td>-</td>
<td>&gt;15</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 3. Estimated Cohesion policy expenditure and co-financing from EU and national funds ml PLN pp. 116

<table>
<thead>
<tr>
<th>2016</th>
<th>2017</th>
<th>2018-2020</th>
<th>2021-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D and entrepreneurship</td>
<td>2 440.27</td>
<td>2783.69</td>
<td>20 269.97</td>
</tr>
</tbody>
</table>

\(^{12}\) Central Statistics Office

\(^{13}\) Share of transfers to Poland in comparison to all amounts transferred to member states within the following MFF 2014-2020: Horizon, Euroatom Research and Training Programme, COSME, Connecting Europe Facility. Values provided in the line are averaged for programmes managed centrally by the EC.